CLAIMS

What is claimed is:

1   1.   A method of qualifying a telephone line for digital subscriber line (DSL) services

2 using a Central Office (CO) DSL modem, comprising:

3   transmitting from the CO DSL modem low frequency signals over the telephone line,

4   wherein the low frequency signals are transmitted through circuitry in the CO

5   DSL modem;

6   receiving reflected versions of the low frequency signals from the telephone line;

7   measuring at the CO DSL modem a transfer function based on the transmitted low

8   frequency signals and received reflected versions of the low frequency signals,

9   wherein the transfer function models characteristics of the telephone line and

10   the circuitry in the CO DSL modem; and

11   qualifying the telephone line based on the transfer function.

1   2.   The method of claim 1, wherein the qualifying step includes:

2   comparing a peak amplitude of the transfer function to a predetermined threshold; and

3   determining that the telephone line is short circuited if the transfer function is less

4   than the predetermined threshold.

1   3.   The method of claim 1, wherein the qualifying step includes:

2   counting a number of peaks associated with the transfer function, thereby defining a

3   number of peaks; and

4   determining that at least one load coil is attached to the telephone line if the number

5   of peaks is greater than one.

1   4.   The method of claim 1, wherein the qualifying step includes:

2   determining the length of the telephone line based on a peak frequency of the transfer

3   function.

1   5.   The method of claim 4, wherein the peak frequency of the transfer function is

2   compared to a number of peak frequency values in a lookup table, and each peak frequency value

3   in the lookup table corresponds to a line length value included in the lookup table.

1   6.   The method of claim 5, wherein each of the peak frequency values is a measured

2   peak frequency associated with a telephone line having a known length, and the corresponding

3   line length value in the lookup table is the known length.

1   7.   The method of claim 5, wherein each of the peak frequency values is a theoretical

2   peak frequency based on a calculated transfer function of a telephone line having a known length, ·

3   and the corresponding line length value is the known length.

1   8.   The method of claim 7, wherein line parameter values of r_{oc} and c_{∞} for a number

2   of wire types are averaged thereby providing an average r_{oc} value and an average c_{∞} value,

3   wherein the average r_{oc} value, the average c_{∞} value, and the known length are used to calculate

4   telephone line resistance and telephone line capacitance of the transfer function thereby allowing

5   each theoretical peak frequency value to be calculated without prior knowledge of specific line

6   parameters associated with the telephone line having the known length.

1   9.   A Central Office (CO) digital subscriber line (DSL) modem configured to

2   determine if a telephone line qualifies for DSL service, the modem comprising:

3   means for transmitting from the CO DSL modem low frequency signals over the

4   telephone line, wherein the low frequency signals are transmitted through

5   circuitry in the CO DSL modem;

6   means for receiving reflected versions of the low frequency signals from the

7   telephone line;

8   means for measuring at the CO DSL modem a transfer function based on the

9   transmitted low frequency signals and received reflected versions of the low

10   frequency signals, wherein the transfer function models characteristics of the

11   telephone line and the circuitry in the CO DSL modem; and

12   means for qualifying the telephone line based on the transfer function.

1   10.   The modem of claim 9, wherein the means for qualifying further includes:

2   a means for comparing a peak amplitude of the transfer function to a predetermined

3   threshold; and

4   a means for determining that the telephone line is short circuited if the transfer

5   function is less than the predetermined threshold.

1   11.   The modem of claim 9, wherein the means for qualifying further includes:

2   a means for counting a number of peaks associated with the transfer function, thereby

3   defining a number of peaks; and

4   a means for determining that at least one load coil is attached to the telephone line if

5   the number of peaks is greater than one.

1   12.   The modem of claim 9, wherein the means for qualifying further includes:

2   a means for determining the length of the telephone line based on a peak frequency of

3   the transfer function.

1   13.   The modem of claim 12, wherein the peak frequency of the transfer function is

2   compared to a number of peak frequency values in a lookup table, each peak frequency value in

3   the lookup table associated with a telephone line length.

1   14.   A method for determining if a telephone line qualifies for digital subscriber line

2   (DSL) service, the method comprising:

3   transmitting from a Central Office (CO) DSL modem low frequency signals over the

4   · telephone line, wherein the low frequency signals are transmitted through

5   circuitry in the CO DSL modem;

6   receiving reflected versions of the low frequency signals from the telephone line;

7   measuring at the CO DSL modem a transfer function based on the transmitted low

8   frequency signals and received reflected versions of the low frequency signals,

9   wherein the transfer function models characteristics of the telephone line and

10   the circuitry in the CO DSL modem;

11   in response to determining that a peak amplitude of the transfer function is less than a

12   predetermined threshold, determining that the telephone line is short circuited;

13   in response to the transfer function having more than one peak, determining that at

14   least one load coil is attached to the telephone line;

15   in response to no short circuits or load coils being associated with the telephone line:

16   comparing a peak frequency of the transfer function to a number of peak frequency

17   values, each peak frequency value associated with a length value; and

18   estimating the length of the telephone line based on one or more of the peak

19   frequency values and their associated length values.

1   15.   The method of claim 14, wherein each of the peak frequency values and

2 corresponding length values are included in the lookup table.

1   16.   The method of claim 14, wherein each of the peak frequency values is a measured

2 peak frequency associated with a telephone line having a known length, and the corresponding

3 length value is the known length.

1   17.   The method of claim 14, wherein each of the peak frequency values is a

2 theoretical peak frequency based on a calculated transfer function of a telephone line having a

3 known length, and the corresponding length value is the known length.

1   18.   The method of claim 17, wherein line parameter values of r_{oc} and c_∞ for a

2 number of wire types are averaged thereby providing an average r_{oc} value and an average c_∞

3 value, wherein the average r_{oc} value, the average c_∞ value, and the known length are used to

4   calculate telephone line resistance and telephone line capacitance of the transfer function thereby

5   allowing each theoretical peak frequency value to be calculated without prior knowledge of

6   specific line parameters associated with the telephone line having the known length.

1   19.   The method of claim 14, wherein the steps of the method are effected by a set of

2   instructions executing on a digital signal processor included in a modem operatively coupled to

3   the telephone line.

4   20.   A computer-readable medium including instructions which, when executed by a

5   processor in a Central Office (CO) digital subscriber line (DSL) modem, cause the modem to

6   perform the operations of:

7   transmitting from the CO DSL modem low frequency signals over the telephone line;

8   receiving reflected versions of the low frequency signals from the telephone line,

9   wherein the low frequency signals are transmitted through circuitry in the CO

10   DSL modem;

11   measuring a transfer function based on the transmitted low frequency signals and

12   received reflected versions of the low frequency signals, wherein the transfer

13   function models characteristics of the telephone line and the circuitry in the

14   CO DSL modem;

15   in response to determining that a peak amplitude of the transfer function is less than a

16   predetermined threshold, determining that the telephone line is short circuited;

17   in response to the transfer function having more than one peak, determining that at

18   least one load coil is attached to the telephone line;

19   in response to no short circuits or load coils being associated with the telephone line:

20   comparing a peak frequency of the transfer function to a number of peak frequency

21   values stored in a lookup table, each peak frequency value in the lookup table

22   associated with a length value included in the lookup table; and

23   estimating the length of the telephone line based on one or more of the peak

24   frequency values and their associated length values.

1 21. A computer-readable medium having instructions contained thereon, which, when

2 executed by a processor in a Central Office (CO) digital subscriber line (DSL) modem, cause the

3 processor to perform the operations of:

4   transmitting from the CO DSL modem low frequency signals over the telephone line,

5   wherein the low frequency signals are transmitted through circuitry in the CO

6   DSL modem;

7   receiving reflected versions of the low frequency signals from the telephone line;

8   measuring at the DSL modem a transfer function based on the transmitted low

9   frequency signals and received reflected versions of the low frequency signals,

10   wherein the transfer function models characteristics of the telephone line and

11   the circuitry in the CO DSL modem; and

12   qualifying the telephone line based on the transfer function.

1 22. A Central Office (CO) digital subscriber line (DSL) modem for qualifying a

2 telephone line for DSL services, comprising:

3   a processor;

4   a memory containing instructions, which, when executed by the processor, cause the

5   processor to perform the operations of:

6   transmitting from the CO DSL modem signals over the telephone line, wherein the

7   low frequency signals are transmitted through circuitry in the CO DSL

8   modem;

9   receiving reflected versions of the signals from the telephone line;

10   measuring at the CO DSL modem a transfer function based on the transmitted and

11   received reflected versions of the signals, wherein the transfer function models

12   characteristics of the telephone line and the circuitry in the CO DSL modem;

13   and

14   qualifying the telephone line based on the transfer function.